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***Cortinarius* of California: eight new species in subg. *Telamonia***

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**ABSTRACT** — Described are eight new species of *Cortinarius* subg. *Telamonia* from California and the Pacific Northwest of North America. Four species fruit in the fall and the other four are vernal. *Cortinarius cisqhale* is a tanoak associate that fruits abundantly in the fall and winter. *Cortinarius athabascus* is an autumnal fruiting species and is broadly distributed throughout the region in conifer and mixed woods. *Cortinarius tuolumnensis*, *C. miwok*, *C. gualalaensis*, and *C. ohlone* belong to the */decipiens* clade — the first two fruit vernaly in boreal and montane habitat while the other two are autumnal at low elevations under coastal pine and live oak, respectively. *Cortinarius eldoradoensis* is a vernal fruiting species abundant in the higher elevations near melting snow. *Cortinarius truckeensis* is a rare, but locally abundant, species known only from its type location near Truckee, California.

**KEY WORDS** — *Cortinariaceae*, fungal taxonomy, nrITS data

**Introduction**

*Cortinarius* subgenus *Telamonia* (Fr.) Trog is well represented in the state of California and the broader North American west. This geographical region features two distinct fruiting periods for *Cortinarius* — autumn, which is typical for the genus worldwide, followed by a rich vernal crop, predominantly in the boreal and montane areas during or shortly after snowmelt. The species composition is quite different between these fruiting periods with almost no overlap; only a few species are known to fruit in both seasons. This suggests that a long evolutionary path of adaptation to seasonal ecological factors has influenced the time of fruiting. While the vernal fruiting phenomenon for *Cortinarius* is not uncommon in Europe, it occurs far more frequently in the arid mountains of western North America.

Subgenus *Telamonia* is poorly studied in California, with only a handful of species reported or described. I am involved in a multi-year study of *Cortinarius* in California and the adjacent subcontinent, supported by extensive molecular

data analyses. Among the number of undescribed species that have emerged are eight common, well-understood taxa in subg. *Telamonia* described here.

## Materials & methods

Methods for morphological studies and DNA extraction, PCR conditions and primers, PCR product clean-up, and sequencing follow Bojantchev & Davis (2011). Collections are stored in the author's private herbarium or at the University of California herbarium in Berkeley (UC) where noted. Extensive iconography of all newly described species is available on <http://www.mushroomhobby.com>. Tree genera are abbreviated with their initial letter, with the exception of *Pi.* = *Picea*; *P.* = *Pinus*; *Ps.* = *Pseudotsuga*.

**PHYLOGENETIC ANALYSIS**—All *Cortinarius* nrDNA sequences from the public databases GenBank (<http://www.ncbi.nlm.nih.gov>) and UNITE (<http://unite.ut.ee/>) were downloaded and reviewed. A representative sample of 205 *Telamonia* sequences from the northern hemisphere (including 72 sequences from the author's collections) were selected for phylogenetic analysis based on whether they [1] provided good clade delineation throughout the entire subgenus or [2] represented taxa closest to the new species described here.

Sequence alignments were generated with MAFFT v6.821b (Katoh et al. 2002) with the G-INS-i global alignment iterative refinement strategy. Minimal gap opening and extension penalties were set for better resolution of the more variable sectors within the nrITS. The alignments were visually inspected and corrected where needed.

Phylogenetic reconstruction utilized Bayesian inference (BI) running on Mr.Bayes v.3.1.1 (Huelsenbeck & Ronquist 2003) with the General Time Reversible substitution model plus gamma distribution (GTR +  $\Gamma$ ) as the best fit recommended by MrModeltest v.2.3 (Posada & Crandall 1998). The BI ran two independent analyses with four chains for 16,000,000 generations with sampling frequency for every 100th generation and a burnin value set at 400,000 (25%). The lowest average standard deviation of split frequencies achieved was 0.008821. A 50% majority rule consensus tree (FIG. 1) was generated with the posterior probability (PP) values showing above or below the branches.

Additional phylogenetic analysis of 38 sequences in the /decipiens clade (with *Cortinarius athabascus* as an outgroup), including all in GenBank that have  $\geq 98\%$  BLAST similarity index to *C. tuolumnensis*, *C. miwok*, *C. gualalaensis* and *C. ohlone*, was inferred using the Maximum Likelihood method based on the Tamura-Nei model as implemented by MEGA5 (Tamura et al. 2007). The resulting tree (FIG. 20) offers a much more detailed view of the /decipiens clade within Western North America, confirming the phylogenetic position of the newly described species as well as illuminating some commonly collected undescribed members of the clade.

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FIG. 1. Phylogram generated by Bayesian inference of 205 *Cortinarius* subg. *Telamonia* nrITS sequences from the northern hemisphere. Two independent analyses with four chains for 16,000,000 generations were run with sampling frequency for every 100th generation and a burnin value set at 40,000 (25%). The posterior probabilities (PP) of the 50% majority rule consensus tree are showing above or below the branches. The branches of the new species described here are colored in red. The GenBank accession numbers are presented after the species names and the author's collection numbers are enclosed in parentheses. Holotype collections are marked by an asterisk. Misapplied species names on GenBank collections are enclosed in quotes.

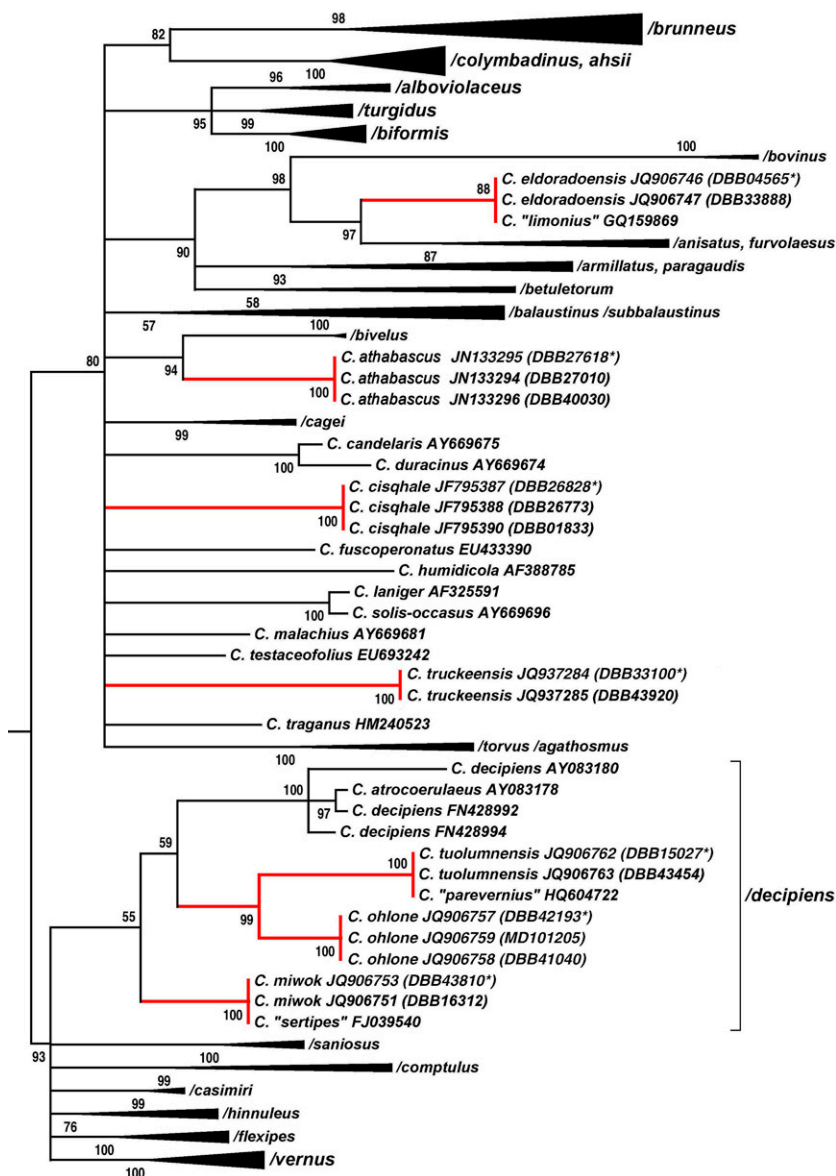




FIG. 2. *Cortinarius cisqhale* (UC 1860822, holotype).

## Taxonomy

### *Cortinarius cisqhale* Bojantchev, sp. nov.

FIGS 2–7

MYCOBANK MB 800343

Differs from other *Telamonia* species by its distinct coloration, small spores, and association with Tanoak.

TYPE: USA. California: Sonoma County, Salt Point State Park, 0.5 mi. North of Hwy 1 (38°33'48"N 123°18'27"W), elev. 300 ft, under *Notholithocarpus densiflorus*, *P. muricata*, *Ps. menziesii*, 20 Nov 2009, Bojantchev DBB26828 (Holotype UC 1860822; Genbank nrITS JF795387, RPB2 JQ906739).

ETYMOLOGY: Císqhale (= beautiful tree) is the word for tanoak in the language of the Kashaya/Pomo Native American people.

PILEUS 40–120 mm diam., very variable in shape, hemispherical to convex when young, typically with a broad flattened umbo; margin involute then straight to flanging; colors diverse, mostly in the light to dark brown spectrum with grayish to olive tinges when wet, pale brownish when dry, often with bluish tinges outside of the disc, with the margins remaining whitish due to persistent velar remnants; surface smooth to shiny when wet, dull fibrillose when dry, hygrophanous in radial streaks, leaving irregular shapes, drying from the center out. LAMELLAE moderately crowded to subdistant, 5–18 mm broad, light or dark clay brown, occasionally lilac when young, turning rusty brown as the spores mature; edges even, pale; attachment sinuate; lamellulae abundant in series of 3–7. STIPE 50–120 mm long, 12–40 mm wide, cylindrical to subclavate, occasionally bulged at the base, frequently laterally subradicating,



FIG. 3. *Cortinarius cisqhale* a) Basidiospores (UC 1860820, holotype) b) DBB27382

light to dark brown beneath the cottony white universal veil, with bluish tinges near the top on young basidiomata; mycelial strands occasionally present in mature basidiomata. UNIVERSAL VEIL gray white, covering the stipe over the entire length, often leaving an annular zone, easily bruised off. CORTINA gray white. CONTEXT mottled, with grayish white zones mixed with brown in the lower stipe and with predominantly bluish tinges in the upper stipe; colors less contrasting at age, settling to grayish brown; bluish tinges stronger near the outer surface. EXSICCATA dark gray to charcoal. HABIT scattered to frequently caespitose of up to a dozen basidiomata. ODOR earthy. TASTE mild earthy. UV LIGHT no fluorescence detected. MACROCHEMICAL REACTIONS 5% KOH negative. SPORE DEPOSIT rusty brown.

BASIDIOSPORES  $(6.5\text{--}7.0\text{--}8.0\text{--}(9.0) \times (3.8\text{--})4.0\text{--}4.6\text{--}(5.0) \mu\text{m}$  (mean  $7.5 \times 4.4 \mu\text{m}$ ),  $Q = 1.59\text{--}1.86$ ,  $Q_{av} = 1.73$  ( $N = 198$ , 8 basidiomata, four collections), amygdaliform to narrowly ellipsoid, slightly ovate, moderately finely verrucose, non-dextrinoid. BASIDIA  $28\text{--}36 \times 5\text{--}7 \mu\text{m}$ , 4-spored, cylindro-clavate, clamped. LAMELLA EDGE sparsely fertile. CYSTIDIA not observed. LAMELLAR TRAMA composed of filamentous hyphae,  $4\text{--}8 \mu\text{m}$  wide, with an olivaceous pigment. PILEIPELLIS a cutis; upper layer composed of parallel hyphae,  $4\text{--}12 \mu\text{m}$  wide, smooth, with olivaceous-brown pigment; lower layer hyphae  $8\text{--}20 \mu\text{m}$  wide, thin walled. No distinct reaction with Melzer's reagent. HYPODERMIUM not observed. OLEIFEROUS HYPHAE common in all parts. CLAMP CONNECTIONS common on all septa.

HABITAT AND DISTRIBUTION — *Cortinarius cisqhale* appears to be associated solely with tanoak (*Notholithocarpus densiflorus*) and broadly distributed throughout its range. It has been collected along the California coast, in southern Oregon and the foothills of Sierra Nevada. At some locations in the fall it can be the most prevalent *Telamonium*. The only matching sequences in GenBank are from environmental studies on tanoak root tips (Bergemann & Garbelotto 2006).

ADDITIONAL COLLECTIONS EXAMINED: **USA. CALIFORNIA:** MENDOCINO COUNTY, Jackson State Demonstration Forest, off Little Lake Rd. (39°18'27"N 123°42'47"W), elev. 1800 ft, under *N. densiflorus*, *Ps. menziesii*, *Tsuga heterophylla*, *Sequoia sempervirens*, 14 Nov 2009, DBB26186; Feb 13, 2010, DBB27382, DBB27520; Jackson State Demonstration Forest, off Hwy 20. (39°21'29"N 123°38'11"W), elev. 1700 ft, under *N. densiflorus*, *Ps. menziesii*, *T. heterophylla*, *S. sempervirens*, Nov 24, 2007, DBB01833 (Genbank nrITS JF795390, RPB2 JQ906737); DBB01834; Nov 23, 2008, DBB09828, DBB10324; **SONOMA COUNTY**, Salt Point State Park, 0.5 mi. North of Hwy 1 (38°33'48"N 123°18'27"W), elev. 450 ft, under *N. densiflorus*, *P. muricata*, *Ps. menziesii*, 23 Nov 2007, DBB01378; 20 Nov 2009, DBB26773 (Genbank nrITS JF795388, RPB2 JQ906738), DBB26876, DBB27028; **YUBA COUNTY**, New Bullard's Bar Reservoir (39°25'23"N 121°05'27"W), elev. 2200 ft, under *N. densiflorus*, *P. ponderosa*, 24 Nov 2010, DBB39790 (Genbank nrITS JQ906745 RPB2 JQ906740); DBB40759; **OREGON:** CURRY COUNTY, Samuel Boardman State Park, elev. 100 ft, under *N. densiflorus*, 11 Nov 2009, Bojantchev DBB27721.

**DISCUSSION** — *Cortinarius cisqhale* is a very variable species with several distinct forms that could easily be interpreted as different species. Careful collecting and observation of basidiomata in all stages of development is required for the synthesis of a refined species concept. In some locales like the Sierra Nevada foothills and Santa Cruz this species tends to form clusters of long-stemmed fruitbodies in a narrowly caespitose habit (FIG. 6a). In wet conditions the coloration becomes distinctly olive-gray (FIG. 3b), while in dry conditions the collections look more like FIG. 4b. The material sometimes can be fairly dark (FIG. 1), while in age it fades to develop a strongly hygrophanous appearance (FIG. 7a,b). The exsiccata have a distinctly blackish-charcoal appearance, similar to *C. brunneus* (Pers.) Fr. and can easily be confused for a member of that clade. The distinctly mottled stem and persistent bluish-grey context coloration in the upper stem context are good taxonomic characters for identifying *C. cisqhale* in the field. A key factor is also the presence of tanoak.

While the nrITS gene region is the primary fungal barcode marker in the *Cortinarius* study used throughout this paper, the diversity of forms in *C. cisqhale* prompted using nrRPB2, an additional gene region that previous analysis of multiple collections (not shown) demonstrated a good species level resolution. The sequences of all examined *C. cisqhale* collections matched 100% in both gene regions.

*Cortinarius cisqhale* is quite isolated from any other sequences in GenBank, with the BLAST max identity index to the nearest neighbor 94% for nrITS and 92% for RPB2. The position of *C. cisqhale* within subg. *Telamonina* was not easily resolved as different methods and packages for phylogenetic reconstruction generated somewhat conflicting results (data not shown). The Bayesian analysis generated the most likely ancestral relationship scenario showing *C. cisqhale* as fairly isolated from most other known species. Future research will undoubtedly shed additional light on its ancestral hierarchy as more closely related species are found.



FIG. 4. *Cortinarius cisqhale* a) DBB39790 b) DBB27028



FIG. 5. *Cortinarius cisqhale* a) DBB09828 b) DBB10324



FIG. 6. *Cortinarius cisqhale* a) DBB40759, caespitose habit b) DBB27520



FIG. 7. *Cortinarius cisqhale* older, dry basidiomata a) DBB01833 b) DBB01834

FIG. 8. *Cortinarius athabascus* DBB27073.***Cortinarius athabascus* Bojantchev, sp. nov.**

FIGS 8–11

MYCOBANK MB 800344

MISAPPLIED NAME – “*Cortinarius brunneus*” sensu Trudell & Ammirati (2009:151).

Differs from other *Telamonia* species by its distinct coloration, conifer association, autumnal fruiting, and western American distribution.

TYPE: USA. California: Mendocino County, Mendocino, off Crestwood Dr. (39°18'18"N 123°47'26"W), elev. 400 ft, under *P. muricata*, 21 Nov 2009, Bojantchev DBB27618 (Holotype UC 1860905; Genbank nrITS JN133295).

ETYMOLOGY: In honor of the Athabascan family of Native American tribes — this species can be found throughout its range along the Pacific coast of North America.

PILEUS 30–150 mm diam., campanulate to convex with 1–3 concentrically raised and depressed zones, typically with a broad flattened umbo; margin involute then straight, often flanging; dark brown with bluish-grey tinges when moist, drying to brown, or pale brown at age, often hygrophanous in concentric zones or radial streaks; veil remnants present at the extreme margin; surface smooth, innately fibrillose, dull when moist, often shiny when dry. LAMELLAE moderately crowded to subdistant, 6–22 mm broad, clay brown, turning rusty brown as the spores mature; edges even to slightly uneven; attachment sinuate; lamellulae abundant in series of 3–5. STIPE 50–180 mm long, 15–50 mm wide, cylindrical to slightly subclavate, often twisted, pale brown beneath the white veil remnants, bluish tinges at the extreme apex often preserved into maturity. UNIVERSAL VEIL white, abundant, covering the stipe over the entire length, often leaving a distinct annular zone, occasionally shedding white floccose scales on the pileus that disappear at maturity. CORTINA white. CONTEXT mottled with white to brown vertical streaks in stipe, with predominantly



FIG. 9. *Cortinarius athabascus* (UC 1860905, holotype) a) Basidiospores b) Basidiomata

bluish tinges in the upper stipe and pronounced orange brown spots at the base. EXSICCATA dark brown, the stipe brown. HABIT mostly scattered, but frequently caespitose. ODOR earthy. TASTE mild earthy. UV LIGHT no fluorescence detected. MACROCHEMICAL REACTIONS 5% KOH negative. SPORE DEPOSIT rusty brown.

**BASIDIOSPORES**  $(8.0\text{--}8.5\text{--}10.0\text{--}10.5) \times (5.0\text{--}5.4\text{--}5.8\text{--}6.3) \mu\text{m}$  (mean  $9.2 \times 5.6 \mu\text{m}$ ),  $Q = 1.51\text{--}1.76$ ,  $Q_{av} = 1.65$  ( $N = 138$ , 5 basidiomata, four collections), amygdaliform to narrow ellipsoid, finely verrucose, non-dextrinoid. **BASIDIA**  $27\text{--}35 \times 5\text{--}8 \mu\text{m}$ , 4-spored, cylindro-clavate, clamped. **LAMELLA EDGE** infertile. **CYSTIDIA** not observed. **LAMELLAR TRAMA** composed of filamentous hyphae,  $3\text{--}8 \mu\text{m}$  wide. **PILEIPELLIS** a cutis, upper layer composed of thin parallel hyphae,  $3\text{--}6 \mu\text{m}$  wide, brownish pigmented in KOH, walls smooth to very finely encrusted. Lower layer hyphae  $5\text{--}18 \mu\text{m}$  wide, with thick hyaline walls. No distinct reaction to Melzer's reagent. **HYPODERMIUM** not observed. **OLEIFEROUS HYPHAE** sparse. **CLAMP CONNECTIONS** common on all septa.

**HABITAT AND DISTRIBUTION** — *Cortinarius athabascus* is widely distributed in northern coastal California and the Pacific Northwest in conifer and mixed woods. It has often been collected in the woods along the northern California coast, Oregon, and the Olympic Peninsula of Washington. There are several matching collections in GenBank, one of which (FJ717542) from Washington state is featured in Trudell & Ammirati (2007) as *C. brunneus*. This species has not been reported yet from the inner mountain ranges of western North America.

**ADDITIONAL COLLECTIONS EXAMINED:** **USA. CALIFORNIA:** MENDOCINO COUNTY, Mendocino, Jackson State Demonstration Forest, off Little Lake Rd. ( $39^{\circ}18'27''\text{N}$   $123^{\circ}42'47''\text{W}$ ), elev. 100 ft, under *Ps. menziesii*, *N. densiflorus*, *T. heterophylla*, *S. sempervirens*, 21 Nov 2009, Bojantchev DBB27073; Gualala, off Old State Hwy ( $38^{\circ}46'07''\text{N}$   $123^{\circ}31'29''\text{W}$ ), elev. 300 ft, under *Ps. menziesii*, *N. densiflorus*, *S. sempervirens*, 26 Nov 2010, Bojantchev DBB40030 (Genbank nrITS JN133296); SONOMA COUNTY, Salt Point State Park, 0.5 mi. North of Hwy 1 ( $38^{\circ}33'48''\text{N}$   $123^{\circ}18'27''\text{W}$ ), elev. 300 ft, under *N. densiflorus*, *P. muricata*, *Ps. menziesii*, 23 Nov 2007, DBB01290 (Genbank nrITS JN133298); 20 Nov 2009, DBB26792 (Genbank nrITS JN133293), DBB27010 (Genbank nrITS JN133294); HUMBOLDT COUNTY, Eureka ( $40^{\circ}49'48''\text{N}$   $124^{\circ}10'45''\text{W}$ ),



FIG. 10. *Cortinarius athabascus* a) DBB40030 b) DBB40030 c) DBB01290



FIG. 11. *Cortinarius athabascus* a) DBB27010 b) DBB27010 b) DBB26792, a paler form

elev. 100 ft, under *Pi. sitchensis*, 20 Nov 2010, DBB39388; OREGON: CURRY COUNTY, Samuel Boardman State Park, elev. 100 ft, under *Pi. sitchensis*, 11 Nov 2009, Bojantchev DBB37325; WASHINGTON: CLALLAM COUNTY, Olympic Peninsula, off Hot Spring Rd. (48°04'29"N 123°57'18"W), elev. 1000 ft, under *Pi. sitchensis*, *Pi. engelmannii*, *Ps. menziesii*, 21 Oct 2009, DBB24697;

**DISCUSSION** — *Cortinarius athabascus* is one of the most common *Telamonia* species in the coastal woods of the Pacific rim of North America. It is also one of the larger *Telamonia* in the area, as it can achieve an impressive size. This species is quite variable in appearance with diverse hygrophanous patterns on the cap, while some forms remain quite pale even when moist. One of the key taxonomic differentials against other local *Telamonia* taxa is the long lasting and very distinct bluish coloration of the stem context in its upper part, even in mature basidiomata. The stepped/depressed multiple rings on the cap with smooth to innately fibrillose surface are good field characteristics too. Based on GenBank records this species is very commonly misidentified in the PNW as various European taxa. Careful analysis of the images presented in this study will help researchers to better comprehend the range of coloration and stature of this common western North American species.

*Cortinarius eldoradoensis* Bojantchev, sp. nov.

FIGS 12–15

MYCOBANK MB 800346

Differs from other *Telamonia* species by the totality of its coloration, montane vernal fruiting habit, and absence of fluorescent universal veil remnants.



FIG. 12. *Cortinarius eldoradoensis* DBB15611. Note the distinct cavities in the stipe.

TYPE: USA. California: El Dorado County, El Dorado National Forest, 0.1 mi. east of Wrights Lake Road (38°48'20"N 120°14'18"W), elev. 6100 ft, under *P. ponderosa*, *Abies concolor*, *A. magnifica*, *Ps. menziesii*, 26 May 2007, Bojantchev DBB04565 (Holotype UC 1861350; Genbank nrITS JQ906746).

ETYMOLOGY: after the Eldorado National Forest in the Central Sierra Nevada.

PILEUS 50–120 mm diam., convex to plano-convex without umbo; margin involute, frequently flanging at age; brown with bluish grey tints towards the disk; the extreme margin frequently whitish due to velar remnants; surface smooth to glossy, innately fibrillose, inconspicuously hygrophanous with occasional radial streaks. LAMELLAE moderately crowded, 7–22 mm broad, latte brown at first, turning rusty brown as the spores mature; edges even, attachment sinuate; lamellulae abundant. STIPE 40–80 mm long, 15–30 mm wide, cylindrical to subclavate, white to beige, sometimes shiny. UNIVERSAL VEIL white, partially covering the lower stipe, often leaving an evanescent annular zone. CORTINA white. CONTEXT white to beige, developing cavities along the length of the stipe. EXSICCATA dark brown. HABIT scattered to sub-caespitose. ODOR earthy. TASTE mild earthy. UV LIGHT no fluorescence detected. MACROCHEMICAL REACTIONS 5% KOH negative. SPORE DEPOSIT rusty brown.

BASIDIOSPORES (8.0–)8.5–10.5(–11.3) × (4.8–)5.0–6.0(–6.5) μm (mean 9.5 × 5.5 μm), Q = 1.34–2.08, Q<sub>av</sub> = 1.73 (N = 203, 7 basidiomata, five collections), variable in shape, mainly amygdaliform, but varying from ovoid to cylindro-amygdaliform to oblong-ellipsoid, moderately verrucose, non-dextrinoid.



FIG. 13. *Cortinarius eldoradoensis* a) DBB15638 b) UC 1861350, holotype



FIG. 14. *Cortinarius eldoradoensis* a) DBB33888 b) DBB15626

BASIDIA  $26\text{--}36 \times 6\text{--}9\text{ }\mu\text{m}$ , 4-spored, cylindro-clavate, clamped. LAMELLA EDGE sparsely fertile. CYSTIDIA not observed. LAMELLAR TRAMA regular, composed of more or less parallel, cylindrical hyphae,  $2\text{--}8\text{ }\mu\text{m}$  wide. PILEIPELLIS a cutis, upper layer composed of thin parallel hyphae,  $3\text{--}5\text{ }\mu\text{m}$  wide with pale olivaceous pigment in KOH, walls smooth, not encrusted. Lower layer hyphae  $6\text{--}22\text{ }\mu\text{m}$  wide, with thin walls. No distinct reaction with Melzer's reagent. HYPODERMIUM

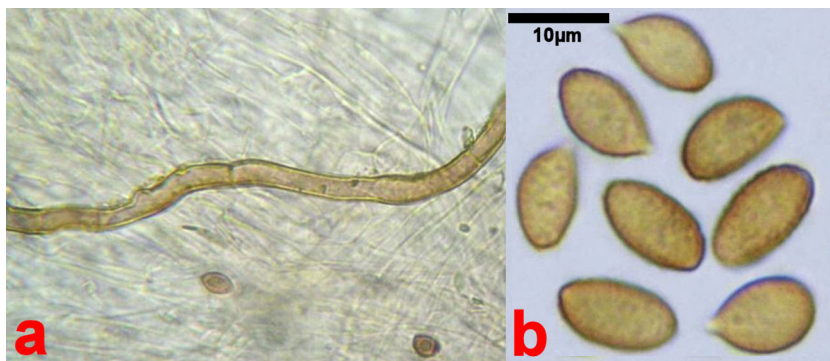


FIG. 15. *Cortinarius eldoradoensis*

- a) Oleiferous hypha in the pileus trama (UC 1861350, holotype)  
b) Basidiospores (UC 1861350, holotype)

not developed. OLEIFEROUS HYPHAE abundant in all parts, with thick refractive walls and olivaceous pigment. CLAMP CONNECTIONS common on all septa.

HABITAT AND DISTRIBUTION — *Cortinarius eldoradoensis* fruits abundantly in late spring and early summer in the mountains of California during, or soon after snow melt. Apparently it is broadly distributed in the Pacific Northwest, yet probably uncommon, as there is only one matching sequence in GenBank (GQ159869) from Mt. Washington, Vancouver Island, British Columbia (also vernal fruiting). In California this species is very common in both the foothills of the Sierra Nevada and the higher elevations of the Sierra–Cascade range where it can frequently be observed right along the banks of melting snow. The typical surrounding trees are conifers like ponderosa pine (*P. ponderosa*), white fir (*A. concolor*), red fir (*A. magnifica*) and Douglas-fir (*Ps. menziesii*).

ADDITIONAL COLLECTIONS EXAMINED: USA. CALIFORNIA: EL DORADO COUNTY, El Dorado National Forest, 0.1 mi. East of Wrights Lake Road (38°48'20"N 120°14'18"W), elev. 6100 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 22 May 2009, DBB15611 (Genbank nrITS JQ906747); DBB15626; DBB15638; TUOLUMNE COUNTY, Yosemite National Park, off Hodgdon Meadow Access Rd (39°18'25"N 123°42'53"W), elev. 5100 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 25 Jun 2010, DBB33888 (Genbank nrITS JQ906748); DBB34062 (Genbank nrITS JQ906749); SIERRA COUNTY, Chapman Creek Campground (39°37'54"N 120°32'37"W), elev. 5900 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 14 May 2010, DBB43454 (Genbank nrITS JQ906750);

DISCUSSION — *Cortinarius eldoradoensis* is a typical member of the rich vernal snowbank *Telamonia* biota of the Sierra–Cascade range. Most of these species share similar brownish coloration and overall stature, which makes them difficult to separate in the field. The problem is exacerbated by the fact that these species fruit in moist spots near melting snow where the soil is very soft and obtaining clean material is difficult. Several years of field observation of multiple collections were needed in order to understand this species better. There is a cluster of several very similar, undescribed, vernal species, which can be separated based on their positive UV fluorescence. The less similar vernal species in the /decipiens clade, like *C. miwok* and *C. tuolumnensis*, develop purplish coloration in the stipe context. In addition, most *C. eldoradoensis* basidiomata develop distinct cavities in the stipe, which can be diagnostic for this species.

### *Cortinarius truckeensis* Bojantchev, sp. nov.

FIGS 16–19

MYCOBANK MB 800349

Differs from other *Telamonia* species by the distinct white coloration, montane vernal fruiting habit, and large spores.

TYPE: USA. California: Nevada County, North of Truckee, off Hwy. 89 (39°24'05"N 120°11'19"W), elev. 6200 ft, under *P. jeffreyi*, 12 Jun 2010, DBB33100 (Holotype UC 1861353; Genbank nrITS JQ937284).



FIG. 16. *Cortinarius truckeensis* (UC 1861353, holotype).

ETYMOLOGY: after the town of Truckee, California in the vicinity of which this species is abundant.

PILEUS 40–100 mm diam., convex to plano-convex to depressed; margin involute into maturity, often wavy; white to light gray-white, remaining so into maturity; surface fibrillose, smooth to shiny, inconspicuously hygrophanous. LAMELLAE moderately crowded to subdistant, 8–26 mm broad, tan to latte brown, without bluish tinges, turning rusty brown as the spores mature; edges even, paler than the sides; attachment sinuate; lamellulae abundant in series of 3–7. STIPE 30–90 mm long, 20–44 mm wide, cylindrical, white, occasionally with a silky shiny surface, solid well into maturity. UNIVERSAL VEIL white, occasionally leaving an evanescent annular zone at the base of the stipe. CORTINA white. CONTEXT white to pale beige, sometimes mottled with tan to brown longitudinal streaks. EXSICCATA brownish with silvery sheen, particularly on the stipes. HABIT subcaespitose to scattered. ODOR earthy. TASTE mild earthy. UV LIGHT no fluorescence detected. MACROCHEMICAL REACTIONS 5% KOH negative. SPORE DEPOSIT rusty brown.

BASIDIOSPORES  $(8.5\text{--}9.0\text{--}11.2\text{--}12.0) \times (4.8\text{--}5.0\text{--}5.5\text{--}6.0) \mu\text{m}$  (mean  $10.1 \times 5.3 \mu\text{m}$ ),  $Q = 1.70\text{--}2.13$ ,  $Q_{av} = 1.91$  ( $N = 146$ , 4 basidiomata, four collections), inequilaterally amygdaliform to broadly fusiform, some strangulated near the apex, very finely verrucose, non-dextrinoid. BASIDIA  $32\text{--}44 \times 7\text{--}10 \mu\text{m}$ , 4-spored (some 2-spored), cylindro-clavate, clamped. LAMELLA EDGE sterile. CYSTIDIA not observed. LAMELLAR TRAMA regular, composed of more or less parallel, cylindrical hyphae,  $4\text{--}10 \mu\text{m}$  wide, with brown intracellular pigment when viewed in KOH. PILEIPELLIS a cutis, upper layer composed of thin parallel hyphae,  $3\text{--}8 \mu\text{m}$  wide with brown pigment in KOH, walls smooth. Lower layer hyphae  $9\text{--}25 \mu\text{m}$  wide, with thin walls. No distinct reaction with Melzer's reagent. HYPODERMIUM well developed. OLEIFEROUS HYPHAE infrequent.

FIG. 17. *Cortinarius truckeensis*

a) Basidiospores (UC 1861353, holotype) b) DBB16054, young basidiomata.

CLAMP CONNECTIONS common on all septa.

HABITAT AND DISTRIBUTION — *Cortinarius truckeensis* is known only from its type location where it has fruited abundantly for several consecutive years. The habitat is composed almost solely of Jeffrey's Pine (*P. jeffreyi*). Despite the extensive field research and many organized forays in the Sierra Nevada, this species has never been collected outside of the type location. Typically, *C. truckeensis* fruits under a very thick conifer duff and rarely breaks above the surface of the forest floor. Most commonly the location of fruiting is marked by a hump that may hide a dozen or more clustered basidiomata.

FIG. 18. *Cortinarius truckeensis* a) DBB33200 b) DBB43920FIG. 19. *Cortinarius truckeensis* mature basidiomata DBB43920 a) DBB43920 b) DBB33200

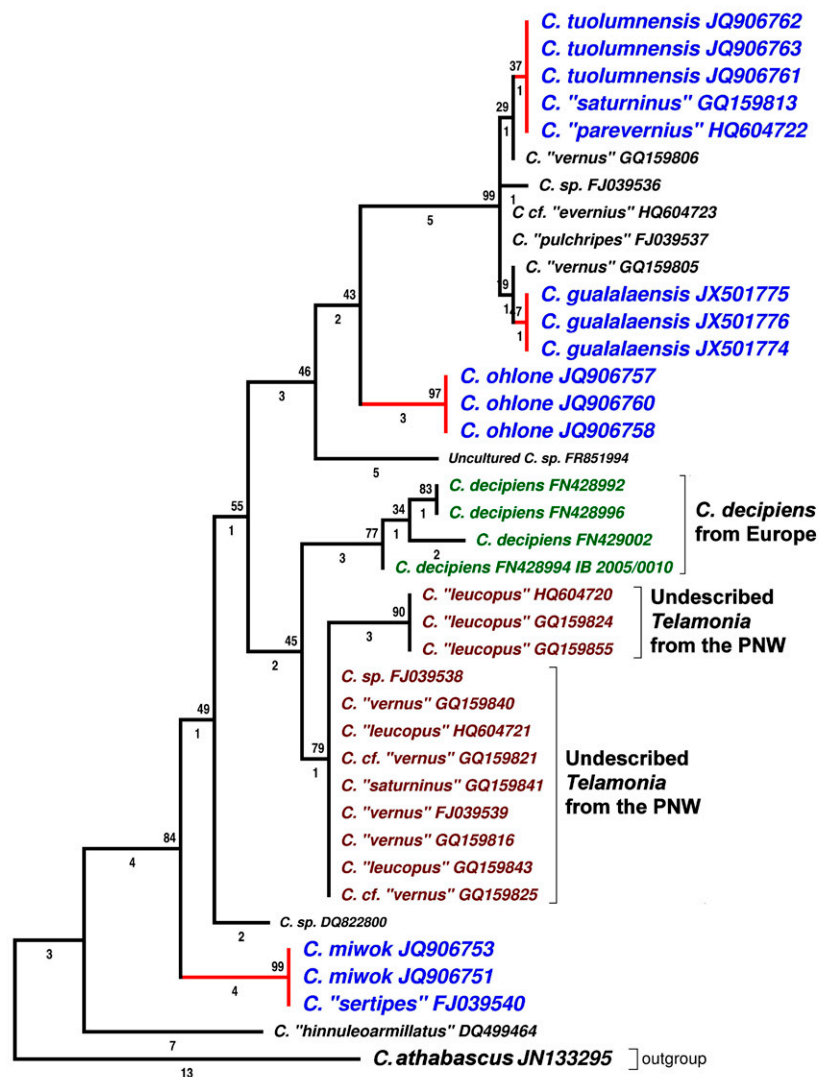


FIG. 20. Phylogenetic tree inferred by Maximum Likelihood analysis of 38 nrITS *Cortinarius* sequences in the /*decipiens* clade (with *C. athabascus* as an outgroup). The tree shows all GenBank sequences that are within 2% BLAST similarity index to *C. tuolumnensis*, *C. miwok*, *C. gualalaensis* and *C. ohlone*. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) are shown above the branches and the branch length values are shown below the branches. GenBank accession numbers are shown after the binomial. Misapplied species names on GenBank collections are enclosed in quotes.

ADDITIONAL COLLECTIONS EXAMINED: USA. CALIFORNIA: NEVADA COUNTY, North of Truckee, off Hwy. 89 (39°24'05"N 120°11'19"W), elev. 6200 ft, under *P. jeffreyi*, 15 Jun 2006, DBB00054; 18 Jun 2009, DBB16054; 12 Jun 2010, DBB33200; 9 Jun 2011, DBB43920 (Genbank nrITS JQ937285);

DISCUSSION — *Cortinarius truckeensis* is one of the most distinctive species in subg. *Telamonia*, and is one of the easiest to identify in the field as the combination of predominantly white coloration, habitat, and season of fruiting sets it apart. One of the unusual features of this species is the spore shape (FIG. 17a) and size that resemble those of the phylogenetically distant species in subg. *Phlegmacium* sect. *Variecolores* Brandrud & Melot.

This species seems somewhat isolated from any of the *Cortinarius* collections represented by sequence data in GenBank and even more so from those in the European public database UNITE. As with *C. cisqhale*, establishing the phylogenetic position of *C. truckeensis* presented difficulties as various packages and methods produced contradictory results. Neighbor-joining and maximum parsimony analyses suggested affinity towards either the /alboviolaceus or the /evernius clades. The Bayesian analysis suggests that this species is somewhat isolated on its own evolutionary path without known close relatives.

### Species in the /decipiens clade

#### *Cortinarius tuolumnensis* Bojantchev, sp. nov.

FIGS 21–24

MYCOBANK MB 800345

Differs from other *Telamonia* species by the distinct context coloration, montane vernal fruiting habit, and spore shape.

TYPE: USA. California: Tuolumne County, Yosemite National Park, off Hodgdon Meadow Access Rd. (37°48'28"N 119°51'19"W), elev. 4600 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 14 May 2009, DBB15027 (Holotype UC 1861347; Genbank nrITS JQ906762).

ETYMOLOGY: after the Tuolumne river and county in the Central Sierra Nevada.

PILEUS 20–90 mm diam., hemispherical to convex when young, plano-convex at age, often with a broad rounded umbo; margin involute then straight; blackish-brown when young and/or moist, lighter reddish-brown to chestnut-brown to cinnamon-brown at maturity or when dry; the disk and umbo remain darker, fading at age; bruising purplish-black, hygrophanous in radial streaks. LAMELLAE moderately crowded to subdistant, 5–12 mm broad, latte brown at first, turning rusty brown as the spores mature; edges slightly uneven, conspicuously lighter in color; attachment sinuate; lamellulae abundant in series of 3–5. STIPE 40–130 mm long, 6–15 mm wide, cylindrical, straight or curved due to caespitose habit, light brown beneath the universal veil, sometimes with grayish-blue tinges near the top; with longitudinal cavity. UNIVERSAL VEIL white, covering the stipe over the entire length, often leaving an annular zone,



FIG. 21. *Cortinarius tuolumnensis* (UC 1861347, holotype).

fibrous at first, sometimes glossy at age. CORTINA white. CONTEXT beige with conspicuous purple-brown bruising in young material, often completely absent with age. EXSICCATA dark brown, stipes brown. HABIT often caespitose of up to a dozen basidiomata, but frequently scattered. ODOR distinctly spicy with a hint of fruit (especially in young basidiomata). TASTE mild. UV LIGHT no fluorescence detected. MACROCHEMICAL REACTIONS 5% KOH negative. SPORE DEPOSIT rusty brown.

BASIDIOSPORES  $(8.5\text{--})9.5\text{--}11.2\text{--}12.5 \times (5.0\text{--})5.7\text{--}6.5\text{--}7.0 \mu\text{m}$  (mean  $10.2 \times 6.1 \mu\text{m}$ ),  $Q = 1.52\text{--}1.88$ ,  $Q_{av} = 1.67$  ( $N = 153$ , 6 basidiomata, five collections), amygdaliform to narrow ellipsoid, slightly ovate, strongly verrucose, more so towards the apex, non-dextrinoid. BASIDIA  $34\text{--}40 \times 8\text{--}10 \mu\text{m}$ , 4-spored (frequently 2-spored), cylindro-clavate, clamped. LAMELLA EDGE sparsely



FIG. 22. *Cortinarius tuolumnensis* a) Basidiospores (UC 1861347, holotype) b) DBB00114



FIG. 23. *Cortinarius tuolumnensis* a) DBB09856 b) DBB43454 c) DBB00112



FIG. 24. *Cortinarius tuolumnensis* DBB00112

a) context discoloration in young basidiomata b) cortina c) clustered/caespitose habit

fertile. CYSTIDIA not observed. LAMELLAR TRAMA regular, composed of more or less parallel, cylindrical hyphae, 2–10  $\mu\text{m}$  wide. PILEIPELLIS a cutis, upper layer composed of thin parallel hyphae, 2–5  $\mu\text{m}$  wide with red-brown pigment in KOH, walls smooth to finely zebra-stripe encrusted. Lower layer hyphae 6–22  $\mu\text{m}$  wide, with thin walls. No distinct reaction with Melzer's reagent. HYPODERMIUM well developed. OLEIFEROUS HYPHAE none observed. CLAMP CONNECTIONS common on all septa.

**HABITAT AND DISTRIBUTION** — *Cortinarius tuolumnensis* fruits abundantly in late spring and early summer in the mountains of California and in the broader Pacific Northwest. There are two matching vernaly fruiting collections represented in GenBank (HQ604722, HQ604723) from Victoria, British Columbia. It appears that the preferred habitat of this species in California is the wet montane meadows (soon after snow melt), surrounded by conifers, mostly pines like Ponderosa pine (*P. ponderosa*).

**ADDITIONAL COLLECTIONS EXAMINED:** USA. CALIFORNIA: EL DORADO COUNTY, El Dorado National Forest, 0.1 mi. SE of Icehouse Road (38°51'24"N 120°22'32"W), elev. 5100 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 14 May 2011, DBB43454 (Genbank nrITS JQ906763); TUOLUMNE COUNTY, Stanislaus National Forest, off Evergreen Rd. (37°49'55"N 119°51'04"W), elev. 4500 ft, under *P. ponderosa*, *A. concolor*, *Ps. menziesii*, 13 May 2007, DBB00112 (Genbank nrITS JQ906761) and DBB00114; 22 May 2008, DBB09856.

**DISCUSSION** — When first observed in the field, *C. tuolumnensis* was easily placed in the /decipiens clade (FIG. 20) due to the purplish discoloration on

the stipe context and distinct spicy odor. That position was confirmed later by the nrITS generated phylogeny. *Cortinarius tuolumnensis* stands out from other clade representatives (such as *C. miwok*) by its caespitose habit and typically longer stems.



FIG. 25. *Cortinarius gualalaensis* (UC 1998883, holotype).

***Cortinarius gualalaensis* Bojantchev, sp. nov.**

FIGS 25–27

MYCOBANK MB 801217

Differs from *C. tuolumnensis* by the autumnal fruiting habit and slightly smaller spores.

TYPE: USA. California: Sonoma County, Jenner, Salt Point Lodge, off Hwy 1. (38°33'24"N 123°18'10"W), elev. 120 ft, under *P. muricata*, 21 November 2010, DBB39900 (Holotype UC 1998883; Genbank nrITS JX501775).

ETYMOLOGY: after the coastal city of Gualala in northern California — the name means “where the river meets the sea” in the language of the Pomo tribe.

PILEUS 20–70 mm diam., hemispherical to convex when young, plano-convex at age, often with a broad rounded umbo; margin straight then flanging; dark-brown when young and/or moist, lighter reddish-brown to chestnut-brown to dull cinnamon-brown at maturity or when dry; the disk and umbo remain darker, fading at age; bruising purplish-black, strongly hygrophanous with fading radial streaks. LAMELLAE moderately crowded to subdistant, 4–15 mm broad, latte brown at first, turning rusty brown as the spores mature; edges slightly uneven, conspicuously lighter in color; attachment sinuate; lamellulae abundant in series of 3–5. STIPE 30–120 mm long, 5–14 mm wide, cylindrical, straight or curved due to caespitose habit, light brown beneath the universal veil remnants, sometimes with grayish-blue tinges near the top; with longitudinal cavity. UNIVERSAL VEIL white, covering the entire stipe, but more prominent in the lower portion, often leaving a faint annular zone, sometimes glossy in age.

CORTINA white. CONTEXT beige with conspicuous purple-brown bruising in young material, often completely absent at age. EXSICCATA dark brown, stipes lighter in color. HABIT mostly caespitose of up to a dozen basidiomata, but frequently scattered. ODOR somewhat spicy (especially in young basidiomata). TASTE mild. UV LIGHT no fluorescence detected. MACROCHEMICAL REACTIONS 5% KOH negative. SPORE DEPOSIT rusty brown.

BASIDIOSPORES  $(8.5\text{--}9.0\text{--}11.0\text{--}11.5) \times (5.8\text{--}6.0\text{--}6.8\text{--}7.3) \mu\text{m}$  (mean  $9.9 \times 6.5 \mu\text{m}$ ),  $Q = 1.42\text{--}1.75$ ,  $Q_{\text{av}} = 1.54$  ( $N = 143$ , 5 basidiomata, three collections), amygdaliform to ellipsoid, distinctly verrucose, more so towards the apex, non-dextrinoid. BASIDIA  $32\text{--}42 \times 7\text{--}11 \mu\text{m}$ , 4-spored (frequently 2-spored), cylindro-clavate, clamped. LAMELLA EDGE sparsely fertile. CYSTIDIA not observed. LAMELLAR TRAMA regular, composed of more or less parallel, cylindrical hyphae,  $3\text{--}12 \mu\text{m}$  wide. PILEIPELLIS a cutis, upper layer composed of thin parallel hyphae,  $2\text{--}6 \mu\text{m}$  wide with red-brown pigment in KOH, walls smooth to finely zebra-stripe encrusted. Lower layer hyphae  $5\text{--}25 \mu\text{m}$  wide, with thin walls. No distinct reaction with Melzer's reagent. HYPODERMIUM well developed. OLEIFEROUS HYPHAE none observed. CLAMP CONNECTIONS common on all septa.

HABITAT AND DISTRIBUTION — *Cortinarius gualalaensis* fruits in the fall and is known only from the coastal areas of California and Oregon. In California, *C. gualalaensis* was collected in dense stands of Bishop pine (*P. muricata*) while in the coastal sand dunes of Oregon this species fruited under Shore pine (*P. contorta* var. *contorta*).



FIG. 26. *Cortinarius gualalaensis* (UC 1998883, holotype) a) Basidiospores b) Basidiomata



FIG. 27. *Cortinarius gualalaensis* a) DBB43121 b) DBB43121 c) DBB23436

ADDITIONAL COLLECTIONS EXAMINED: USA. CALIFORNIA: SONOMA COUNTY, Salt Point State Park, 0.5 mi. North of Hwy 1 (38°33'48"N 123°18'27"W), elev. 300 ft, under *P. muricata*, 27 Nov 2011, DBB43121 (Genbank nrITS JX501776); OREGON: LANE COUNTY, Jessie M. Honeyman Memorial State Park (43°55'48"N 124°06'26"W), elev. 80 ft, under *P. contorta* var. *contorta*, 9 Nov 2009, DBB23436 (Genbank nrITS JX501774);

DISCUSSION — *Cortinarius gualalaensis* is very closely related to *C. tuolumnensis* and appears very similar in stature, colors, and the clustered habit. The major differentiating character is the time of fruiting — *C. tuolumnensis* fruits in the spring and *C. gualalaensis* in the autumn. Microscopically, *C. gualalaensis* spores are a bit shorter and wider, with a smaller  $Q_{av}$ .



FIG. 28. *Cortinarius ohlone* DBB41040.

*Cortinarius ohlone* Bojantchev, sp. nov.

FIGS 28–31

MYCOBANK MB 800348

Differs from other *Telamonia* by the unique coloration and association to oaks in California and adjacent regions.

TYPE: USA. California: Contra Costa County, Kennedy Grove (37°56'47"N 122°15'58"W), elev. 100 ft, under *Quercus agrifolia*, 23 Jan 2011, DBB42193 (Holotype UC 1861349; Genbank nrITS JQ906757).

ETYMOLOGY: In honor of the Ohlone Native American people — this species can be found in the oak woods of northern California that they inhabited.

PILEUS 30–80 mm diam., convex to plano-convex, rarely with a broad rounded umbo; margin more or less involute into maturity; dark brown to grey-brown. When young with dark bluish-gray cast, turning cinnamon brown at

FIG. 29. *Cortinarius ohlone*

a) Basidiospores (UC 1861349, holotype)

b) DBB05460, young basidiomata with dark bluish-gray cast on the pileus

maturity; surface fibrillose, smooth to shiny, inconspicuously hygrophanous with radial streaks. LAMELLAE moderately crowded to subdistant, 5–18 mm broad, dark clay brown, without bluish tinges, turning rusty brown as the spores mature; edges slightly uneven, much paler than the sides; attachment sinuate; lamellulae abundant in series of 3–7. STIPE 30–120 mm long, 12–24 mm wide, cylindrical, white to pale beige. UNIVERSAL VEIL white, partially covering the lower stipe, leaving an evanescent annular zone. CORTINA white. CONTEXT beige to white, bruising purplish-brown slightly, stipe frequently hollow at maturity. EXSICCATA dark brown. HABIT scattered to subcaespitose. ODOR distinctly spicy somewhat like cedar wood. TASTE mild. UV LIGHT no fluorescence detected. MACROCHEMICAL REACTIONS 5% KOH negative. SPORE DEPOSIT rusty brown.

BASIDIOSPORES  $(6.8\text{--}7.2\text{--}8.2(-9.0) \times (4.8\text{--}5.0\text{--}5.6(-6.0) \mu\text{m})$  (mean  $7.8 \times 5.2 \mu\text{m}$ ),  $Q = 1.42\text{--}1.60$ ,  $Q_{\text{av}} = 1.50$  ( $N = 134$ , 5 basidiomata, four collections), amygdaliform to ellipsoid, ovoid, or broadly ellipsoid, finely verrucose, non-dextrinoid. BASIDIA  $26\text{--}40 \times 6\text{--}8 \mu\text{m}$ , 4-spored (rarely 2-spored), cylindro-clavate, clamped. LAMELLA EDGE sterile. CYSTIDIA not observed. LAMELLAR TRAMA regular, composed of more or less parallel, cylindrical hyphae, 3–7  $\mu\text{m}$  wide. PILEIPELLIS a cutis; epicutis composed of thin parallel hyphae, 2–7  $\mu\text{m}$  wide with brown pigment in KOH; walls smooth to very finely zebra-stripe encrusted. Lower layer hyphae 8–22  $\mu\text{m}$  wide, with thin walls. No distinct reaction with Melzer's reagent. HYPODERMIUM well developed. OLEIFEROUS HYPHAE infrequent. CLAMP CONNECTIONS common on all septa.

HABITAT AND DISTRIBUTION — *Cortinarius ohlone* is fairly common under evergreen oaks throughout California and its distribution appears limited to the state. The primary mycorrhizal associates are coast live oak (*Q. agrifolia*) and interior live oak (*Q. wislizenii*).

FIG. 30. *Cortinarius ohlone*

a) DBB41040, an annular zone on the stipe b) DBB42193 (UC 1861349, holotype)

ADDITIONAL COLLECTIONS EXAMINED: **USA. CALIFORNIA:** CONTRA COSTA COUNTY, San Pablo Dam (37°54'16"N 122°12'55"W), elev. 150 ft, under *Q. agrifolia*, 2 Jan 2008, DBB05460 (Genbank nrITS JQ906760); SANTA CRUZ COUNTY, Santa Cruz, UCSC Campus (36°59'49"N 122°04'02"W), elev. 600 ft, under *Q. agrifolia*, 22 Dec 2010, DBB41040 (Genbank nrITS JQ906758); RIVERSIDE COUNTY, Cleveland National Forest, off Forest Road 6S05 (33°38'18"N 117°25'21"W), elev. 1300 ft, under *Q. agrifolia*, *Q. wislizenii*, 12 Feb 2011, DBB42536; YOLO COUNTY, Putah Creek State Wildlife Reserve, Franklin Canyon, (38°30'23"N 122°05'51"W), elev. 1000 ft, under *Q. agrifolia*, *Q. wislizenii*, 6 Jan 2011, R. M. Davis RMD101205 (Genbank nrITS JQ906759);

DISCUSSION — *Cortinarius ohlone* is the most common of several small to medium-sized brownish *Telamonina* species in the oak woods of northern California. The diversity of this group seems to increase in the warmer oak habitats of southern California. A key diagnostic feature for differentiating *C. ohlone* from other similar cortinariid in the same habitat is the slight to pronounced spicy-fragrant odor (reminiscent of cedar wood), which is typical for the members of the /decipiens clade.

FIG. 31. *Cortinarius ohlone* a) DBB42536, older basidiomata b) RMD101205



FIG. 32. *Cortinarius miwok* (UC 1861351, holotype).

***Cortinarius miwok* Bojantchev, sp. nov.**

FIGS 32–34

MYCOBANK MB 800347

Differs from *C. ohlone* by its coniferous association and montane vernal fruiting habit.

TYPE: USA. California: El Dorado County, El Dorado National Forest, 0.1 mi. SE of Icehouse Road (38°51'24"N 120°22'32"W), elev. 5100 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 5 Jun 2011, DBB43810 (Holotype UC 1861351; Genbank nrITS JQ906753).

ETYMOLOGY: In honor of the Miwok Native American people — this species can frequently be found in the Sierra Nevada areas that they inhabited.

PILEUS 30–70 mm diam., convex to plano-convex, often with a broad flattened umbo; margin involute then straight to flanging; dark to light grey-brown, turning brown at maturity, the extreme margin whitish due to persistent veil remnants; surface fibrillose, smooth to shiny, inconspicuously hygrophanous. LAMELLAE moderately crowded to subdistant, 6–20 mm broad, clay brown, no bluish tinges, turning rusty brown as the spores mature; edges slightly uneven, pale; attachment sinuate; lamellulae abundant in series of 3–7. STIPE 30–80 mm long, 15–30 mm wide, cylindrical to subclavate, white to light brown beneath the universal veil remnants, bruising purplish-brown, rarely with bluish tinges



FIG. 33. *Cortinarius miwok* a) Basidiospores (UC 1861351, holotype) b) DBB43988

near the top on young basidiomata. UNIVERSAL VEIL white, partially covering the stipe in the lower half, leaving an evanescent annular zone. CORTINA white. CONTEXT beige to white, bruising purplish-brown slightly, stipe frequently hollow at maturity. EXSICCATA dark brown. HABIT scattered to subcaespitose. ODOR slightly spicy, or moldy if surrounded by wet soil. TASTE mild. UV LIGHT no fluorescence detected. MACROCHEMICAL REACTIONS 5% KOH negative. SPORE DEPOSIT rusty brown.

BASIDIOSPORES  $(6.8-7.2-9.0(-9.3) \times (3.8-4.0-5.0(-5.3) \mu\text{m}$  (mean  $8.2 \times 4.5 \mu\text{m}$ ),  $Q = 1.60-2.14$ ,  $Q_{\text{av}} = 1.82$  ( $N = 177$ , 7 basidiomata, four collections), amygdaliform to cylindro-amygdaliform, finely verrucose, non-dextrinoid. BASIDIA  $28-38 \times 6-9 \mu\text{m}$ , 4-spored (occasionally 2-spored), cylindro-clavate, clamped. LAMELLA EDGE sparsely fertile. CYSTIDIA not observed. LAMELLAR TRAMA regular, composed of more or less parallel, cylindrical hyphae,  $2-8 \mu\text{m}$  wide. PILEIPELLIS a cutis; upper layer composed of thin parallel hyphae,  $2-6 \mu\text{m}$  wide with olivaceous-brown pigment in KOH; walls smooth to finely zebra-stripe encrusted. Lower layer hyphae  $7-20 \mu\text{m}$  wide, with thin walls. No distinct reaction with Melzer's reagent. HYPODERMIUM well developed. OLEIFEROUS HYPHAE infrequent. CLAMP CONNECTIONS common on all septa.

HABITAT AND DISTRIBUTION — *Cortinarius miwok* fruits in late spring and early summer in the California mountains during, or soon after, snow melt. It is one of the less common species amongst the vernal fruiting cortinari. Apparently it occurs in the Pacific Northwest, where it may be uncommon, as there is only one matching sequence in GenBank (FJ039540; also vernal fruiting but incorrectly designated as *C. sertipes* from a collection made at Observatory Hill, Vancouver Island, British Columbia]. In California *C. miwok* occurs in the foothills and higher elevations of the Sierra-Cascade range, where it can frequently be observed near melting snow. The surrounding conifer habitat consists primarily of ponderosa pine (*P. ponderosa*), white fir (*A. concolor*), red fir (*A. magnifica*), lodgepole pine (*P. contorta* var. *latifolia*) and Douglas-fir (*Ps. menziesii*).

ADDITIONAL COLLECTIONS EXAMINED: **USA. CALIFORNIA:** EL DORADO COUNTY, El Dorado National Forest, 0.1 mi. SE of Icehouse Road (38°51'24"N 120°22'32"W), elev. 5100 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 5 Jun 2011, DBB43976 (Genbank nrITS JQ906754); TUOLUMNE COUNTY, Yosemite National Park, off Tioga Pass Rd. (37°50'12"N 119°40'48"W), elev. 7300 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 20 Jun 2009, DBB16312 (Genbank nrITS JQ906751); SIERRA COUNTY, SF State Sierra Nevada Field campus (39°37'23"N 120°34'48"W), elev. 5700 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 9 Jun 2011, DBB43988 (Genbank nrITS JQ906755); Chapman Creek Campground (39°37'54"N 120°32'37"W), elev. 5900 ft, under *P. ponderosa*, *A. concolor*, *A. magnifica*, *Ps. menziesii*, 22 Jun 2010, DBB33741 (Genbank nrITS JQ906752);

**DISCUSSION** — *Cortinarius miwok* stands out from the other vernal cortinariid with similar stature in the same surroundings by the more bluish-grey cap and slight purplish discoloration of the context. This species also exhibits the slightly spicy odor typical of the /decipiens clade. Its closest relative in the same habitat is *C. tuolumnensis*, which can be distinguished by its predominantly caespitose habit and longer stems. Microscopically, *C. miwok* can be separated from *C. tuolumnensis* by the smaller spores.



FIG. 34. *Cortinarius miwok* a) DBB16312 b) DBB43976

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### Literature cited

- Bergemann, SE, Garbelotto M. 2006. High diversity of fungi recovered from the roots of mature tanoak (*Lithocarpus densiflorus*) in northern California. *Can J Bot* 84: 1380–1394. <http://dx.doi.org/10.1139/B06-097>
- Bojantchev D, Davis RM. 2011. *Cortinarius xanthodryophilus* sp. nov. — a common *Phlegmacium* under oaks in California. *Mycotaxon* 116: 317–328. <http://dx.doi.org/10.5248/116.317>

- Huelsenbeck JP, Ronquist F. 2001. MRBAYES: Bayesian inference of phylogenetic trees. *Bioinformatics* 17: 754–755. <http://dx.doi.org/10.1093/bioinformatics/17.8.754>
- Katoh K, Misawa K, Kuma KI, Miyata T. 2002. MAFFT: a novel method for rapid multiple sequence alignment based on fast Fourier transform. *Nucleic Acids Res* 30: 3059–3066. <http://dx.doi.org/10.1093/nar/gkf436>
- Posada D, Crandall KA. 1998. Modeltest: testing the model of DNA substitution. *Bioinformatics* 14: 817–818.
- Tamura K, Dudley J, Nei M, Kumar S. 2007. MEGA4: Molecular Evolutionary Genetics Analysis (MEGA) software version 4.0. *Mol Biol Evol* 24: 1596–1599. <http://dx.doi.org/10.1093/molbev/msm092>
- Trudell S, Ammirati JF. 2009. *Mushrooms of the Pacific Northwest*. Timber Press. Portland.